

**Date:** March 22, 2016

**To:** Thomas J. Bonfield, City Manager  
**Through:** W. Bowman Ferguson, Deputy City Manager  
**From:** Donald F. Greeley, Director, Water Management  
**Subject:** Amendment No. 1 to Agreement to Provide Professional Services for Dam Inspections, Maintenance and Rehabilitation

### **Executive Summary**

On December 15, 2014 City Council awarded a professional engineering consulting services contract to Schnabel Engineering South, PC for Dam Inspections, Maintenance and Rehabilitation at the Lake Michie and Little River Dams. The original scope of services included annual dam safety inspections, annual Emergency Action Plan (EAP) updates, structural condition assessments, and development of a 50-year rehabilitation plan for repair and maintenance of the dams and pump station facilities for a total fee of \$1,084,542.00, which included a contingency amount of \$98,000.000.

The rehabilitation plan resulted in numerous recommendations for capital improvement projects to be completed over the next 10 years to ensure the continued safe and reliable operation of both dams for the next 50 years. The Department recommends approval of Amendment No. 1 for \$610,000.00 to perform detailed evaluation and analysis of the dam structures that will be required to identify appropriate engineering alternatives and inform future engineering design efforts for some of the rehabilitation projects.

### **Recommendation**

The Department recommends City Council:

1. Authorize the City Manager to execute contract Amendment No. 1 with Schnabel Engineering South, PC for the Dam Inspections, Maintenance and Rehabilitation Project in the amount of \$610,000.00.
2. Authorize the City Manager to negotiate change orders for the contract, provided that the total project cost does not exceed \$1,694,542.00.

### **Background**

The Department of Water Management (DWM) operates two raw water supply reservoirs controlled by Little River Dam (completed 1987) and Lake Michie Dam (completed 1927). Safety inspections must be conducted annually, along with EAP updates to ensure protection of downstream property owners as well as the City's water supply. Long term rehabilitation planning for these two aging facilities will allow the DWM to prioritize capital improvement projects and ensure the best use of financial resources.

Under the original contract, Schnabel provided the following professional engineering services:

Phase 1: Continuation of annual dam safety inspections, annual Operation and Maintenance (O&M) Plan updates, and annual EAP updates at Lake Michie and Little River Dams. The original contract covered these annual inspections for a five year term (2014-2018).

- Phase 2: Condition assessment of various dam and pump station assets and development of a 50-year plan for rehabilitation and capital improvements at both dams. This effort is complete.
- Phase 3: Development of preventative maintenance activities and schedules for dam structures and pump station equipment at both dams. This effort is complete.
- Phase 4: Engineering evaluation and design services for removal of trees growing in the Lake Michie Dam embankment and repair of a damaged sluice gate and screen at Little River Dam. These projects are ongoing.

The initial condition assessment that was completed under Phase 2 of the original contract was intended to provide basic condition assessment ratings for hundreds of dam and pump station components in order to determine and prioritize needs for asset replacement and/or repair. This work identified numerous deficiencies that must be addressed at both dams in order to ensure safe and reliable operation of the facilities over the next 50-year period. The projects included under Amendment 1 resulted from the work done under the original contract, and could not have been anticipated at the time the original contract scope was developed. These projects represent the first stage of long-term rehabilitation toward addressing the identified deficiencies. Many of the evaluations included in Amendment 1 stem from the fact that Lake Michie Dam was constructed in the 1920's and does not meet current North Carolina Dam Safety regulatory requirements with regards to stability and spillway capacity. Once improvements are initiated to keep the dam operational, the State will require the dam to be brought up to current safety standards. The evaluation and analysis described below is required to: a) determine appropriate engineering solutions to address identified deficiencies and b) inform the future engineering design process for selected solutions. Engineering design for rehabilitation projects will be provided under a future contract amendment or in some cases, separate contracts.

### Issues and Analysis

Amendment No. 1 includes detailed analysis and evaluation, identification of engineering alternatives, and development of conceptual plans for necessary repairs identified in the 50-year Rehabilitation Plan. Amendment No. 1 will provide the following services:

Phase 5: Lake Michie:

- A. **Flush the dam drainage system to restore functionality.** During work completed under the original contract, it was determined that the existing drainage system has become clogged and is only functioning at about 25% of its intended capacity. The drainage system is critical to reduce uplift pressures on the concrete spillway section of the dam and maintain dam stability. Once flushing is complete, the drainage system will be assessed to determine functionality.
- B. **Perform incremental damage analysis to determine the appropriate regulatory design storm.** The work completed under the original contract determined that because Lake Michie Dam was constructed in the 1920s, prior to the existence of North Carolina Dam Safety regulations, it does not meet current safety criteria for spillway capacity. Detailed hydrologic modeling will be performed to determine the appropriate regulatory design storm taking into account modern downstream conditions. Based on the results of this exercise, recommendations will be made regarding the need to modify the spillway to increase its overflow capacity.
- C. **Rehabilitate existing manual piezometers and install new automated piezometers to accurately record ground water levels.** During the work performed under the original contract, it was determined that the existing piezometers

have become clogged, and are no longer providing accurate readings of groundwater levels. Accurate and reliable monitoring of groundwater levels is needed to detect potential changes over time that could result in reduced dam stability. Following piezometer rehabilitation, the groundwater monitoring system will be assessed to confirm functionality. Should piezometer rehabilitation be unsuccessful, new piezometers will be installed.

- D. **Evaluate abandonment of non-functioning lake low-level drains and identify alternatives for meeting regulatory requirements for draining the lake.** The original condition assessment determined that Lake Michie Dam does not meet current NC Dam Safety criteria because the low-level lake drain is not functional. This evaluation will identify a means to safely abandon the existing non-functioning drain, and will evaluate alternative methods for draining the lake that would comply with current NC Dam Safety standards.
- E. **Conduct a stability analysis for the earthen embankment and identify corrective measures, if necessary.** During the original condition assessment, a previously unknown core wall within the earthen embankment was discovered. A detailed stability analysis will identify the extent of this core wall, collect data on the subsurface materials present, and evaluate how the existing conditions impact stability of the earthen embankment. If necessary based on the results of the stability analysis, a conceptual plan for embankment improvements will be provided.
- F. **Conduct a stability analysis of the concrete spillway and evaluate use of post tensioning anchors.** Preliminary stability calculations conducted during the initial phase of work showed that Lake Michie Dam does not meet current NC Dam Safety Criteria for spillway stability. A detailed analysis is needed to core the concrete structure, and perform an in-depth engineering analysis once more information can be collected about the internal composition and construction methods used to construct the dam. The results of the analysis will allow engineers to determine whether the installation of post tensioning anchors will improve spillway stability and prevent dam failure.
- G. **Develop conceptual plan for repair of undermined right tailrace wall.** During the initial condition assessment, underwater dive inspectors identified an undermined area around the right tailrace wall, located downstream of the raw water pump station. The tailrace wall will be cored to provide information about the material and construction methods used to build the wall. A conceptual plan will be developed for repairing the wall, which will include methods for diverting water during construction.
- H. **Collect topographical survey data, and conduct a subsurface drilling investigation to collect information on properties of the embankment soils and dam construction materials.** This information is needed to inform the analyses described in items B. through G., above.

Phase 6: Little River:

- A. **Conduct a seepage and stability analysis for the earthen embankment.** During the initial condition assessment, it was determined that a required seepage and stability analysis required by NC Dam Safety criteria was never completed for Little River Dam. This analysis is needed to fully comply with existing NC Dam Safety regulations.
- B. **Conduct a study of gate operations and flooding analysis.** Conditions upstream and downstream of Little River Dam have changed in the 30 years since the reservoir was constructed. This study will evaluate how floodgate operations under varying flood stage conditions will impact current upstream and downstream properties and assets. If needed, recommendations will be made for modifications to standard operating procedures for the floodgates.
- C. **Develop concrete pier condition evaluation and repair plan.** During the initial condition assessment of the dam structure, an area of deteriorating concrete was discovered on a concrete pier between spillway gates. The pier will be cored and tested to determine whether the deterioration is being caused by a specific chemical reaction. Based on the results of the testing, an appropriate repair plan will be developed.
- D. **Perform quarterly inspections of raw water pipeline tunnel.** During the initial safety inspections, significant sediment accumulation was observed in the pipeline tunnel that connects the raw water intake to the raw water pumping station. Additional quarterly inspections will be conducted to determine whether the sediment accumulation is increasing over time, which could indicate a concern with the structural integrity of the tunnel.

The negotiated fees for the proposed Amendment No. 1 are summarized below, along with the original contract fees:

Item	Fee
<b>Original Contract Amount – Base</b>	<b>\$ 986,542.00</b>
<b>Original Contract Contingency</b>	<b>\$ 98,000.00</b>
<b>Amendment No. 1 Tasks:</b>	
Phase 5: Lake Michie Additional Evaluation and Analysis	\$ 561,000.00
Phase 6: Little River Additional Evaluation and Analysis:	\$ 49,000.00
<b>Subtotal Amendment No. 1</b>	<b>\$ 610,000.00</b>
<b>Total Amended Contract Amount Plus Contingency</b>	<b>\$ 1,694,542.00</b>

Since the entire original contract contingency amount is still available, no additional contingency is requested under Amendment No. 1.

### Alternatives

Alternative 1: Do not go forward with the project. This is not recommended at this time. Lake Michie Dam was completed in 1927 and will require multiple improvements to ensure safe and reliable operation over the next 50 year period. The evaluation items outlined for Phase 5 are necessary to develop engineering alternatives and inform the design process for these future improvements. Without further evaluation and improvements, DWM will need to plan for construction of a new dam by 2025. Although much newer (1987), the evaluation items outlined in Phase 6 are necessary in order to maintain Little River Dam in good condition over its intended life.

### Financial Impact

Funding for the amendment is available in the following accounts:

4100P002	731004	P0501	\$610,000.00
4100P002	731900	P0501	\$98,000.000
Total			\$708,000.00

As a result of their previous work under the original contract, Schnabel Engineering, South PC is familiar with the existing conditions, necessary rehabilitation, and regulatory issues associated with both dams. Amending this contract with Schnabel Engineering South, PC will be the most cost effective way to complete the necessary work described herein.

### SDBE Summary

This is a contract amendment. Schnabel Engineering South, PC will be using the following SDBE firm for the additional scope of services:

Firm	ID	City/State	Amount	% of Contract
CH Engineering, PLLC	WSDBE	Raleigh, NC	\$ 27,568	4.5%